Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (currently amended): A method of coating a surface of a titanium based ~~surface~~ substrate to provide oxidation protection and improved fatigue properties at elevated temperatures, comprising:

applying ~~a protective coating to the surface, the coating being applied to the surface and having~~ an aluminum conversion layer to the surface, wherein the aluminum conversion layer is applied at a temperature below which aluminum does not appreciably react with titanium, and wherein the aluminum conversion layer is applied to ~~of~~ a thickness of ~~less than~~ from about 2 to 12 microns; and

heat treating the aluminum conversion layer so that a first portion of the aluminum oxidizes to form an alumina layer and a second portion of the aluminum interacts with the titanium within the titanium based substrate to form titanium aluminide.

2. (currently amended): The method of Claim 1, wherein ~~said coating~~ the titanium aluminide is formed as a layer having ~~is applied at~~ a thickness of ~~between about 2 to 12~~ from about 2 to 15 microns.

3. (original): The method of Claim 1, wherein the aluminum conversion layer is transformed to titanium aluminide by heating at a controlled rate above about 500°C followed by a hold at a temperature no more than about 750°C, and cooling at a controlled rate back down to about 500°C.

4. (currently amended): The method of Claim 1, wherein the aluminum conversion layer is applied by gaseous deposition.

5. (original): The method of Claim 4, wherein the gaseous deposition and heat-treating are performed separately.

6. (currently amended): The method of Claim 1, wherein the aluminum conversion layer is applied at a temperature below 450°C.

7. (currently amended): The method of Claim 1, wherein the titanium aluminide is disposed between the alumina layer and the titanium based substrate ~~conversion layer is oxidized to form an alumina surface layer~~.

8-11. (cancelled)

12. (currently amended): A method of applying a coating to a titanium-based substrate, comprising:

cleaning a surface of the titanium-based substrate with a dilute caustic solution of KOH;

thereafter, applying an aluminum conversion layer ~~of between 2 to 12 microns~~ on the substrate ~~by gaseous deposition, the aluminum conversion layer being deposited at a temperature below which aluminum does not appreciably react with titanium and below the melting point of Al~~; and

heat-treating the aluminum conversion layer so that the aluminum oxidizes to form alumina and interacts with the titanium to form ~~the~~ titanium aluminide, ~~and~~ wherein a portion of the aluminum conversion layer is oxidized to form an alumina surface layer.

13. (currently amended): The method of Claim 12; wherein the aluminum conv rsion layer is applied at a temperature below 450°C.

14-15. (canceled)

16. (currently amended): The method of Claim ~~15~~ 12, wherein the aluminum conversion layer is transformed to titanium aluminide by heating at a controlled rate to a temperature of below 640°C ~~after cleaning the surface~~.

17. (currently amended): A method of coating a surface of a titanium based ~~surface~~ substrate to provide oxidation protection at elevated temperatures, comprising:

cleaning the surface of the titanium-based substrate with a dilute caustic solution of KOH;

thereafter, applying ~~a protective coating to the surface, the coating being applied by applying~~ an aluminum conversion layer to the surface at a temperature below which aluminum does not appreciably react with titanium ~~and of a thickness of less than 12 microns~~; and

heat treating the aluminum conversion layer so that the aluminum oxidizes and interacts with the titanium to form titanium aluminide~~; and~~

~~cleaning the titanium-based alloy surface prior to applying a protective coating~~.

18. (canceled)

19. (currently amended): The method of Claim ~~18~~ 17, wherein the aluminum conversion layer is transformed to titanium aluminide by heating at a controlled rate of below 640°C ~~after cleaning the surface~~.

20-24. (canceled)

25. (currently amended): A method of applying a coating to a brazed substrate, the substrate having a braze thereon, the braze including titanium, the method comprising:

applying an aluminum conversion layer ~~of between 2 to 12 microns~~ on the braze ~~substrate by gaseous deposition~~, the layer being deposited at a temperature below which aluminum does not appreciably react with ~~any~~ titanium ~~which may or may not be present in the braze~~; and

heat treating the aluminum conversion layer so that the aluminum oxidizes to form alumina~~, and if the braze contains Ti,~~ and interacts with the titanium to form a layer of titanium aluminide on the brazed substrate.

26. (new): The method of Claim 1, wherein the titanium aluminide comprises the phase $TiAl_3$.

27. (new): The method of Claim 1, wherein the alumina layer has a thickness of from about 0.5 to 5 microns.

28. (new) The method of Claim 12, wherein the aluminum conversion layer is applied at a thickness of between 2 to 12 microns.

29. (new): The method of Claim 25, wherein the alumina forms an outer alumina layer, and the layer of titanium aluminide is disposed between the alumina layer and the braze.

30. (new): A method for forming an oxidation protective coating on a titanium-based substrate, comprising:

a) depositing an aluminum conversion layer on a surface of the titanium-based substrate, wherein the aluminum conversion layer comprises aluminum;

b) oxidizing a first portion of the aluminum to form an outer alumina layer; and

c) reacting a second portion of the aluminum with titanium of the titanium-based substrate to form a layer of titanium aluminide beneath the alumina layer, wherein step b) is performed at a first temperature, and step c) is performed at a second temperature, and wherein the second temperature is higher than the first temperature.

31. (new): The method of Claim 30, wherein the first temperature is about 400° C.

32. (new): The method of Claim 31, wherein the second temperature is about 700° C.

33. (new): The method of Claim 30, wherein step a) is performed at a temperature less than about 550° C.

34. (new): The method of Claim 30, wherein step a) is performed at a temperature of from about 200 to 300° C.

35. (new): The method of Claim 30, further comprising: prior to step a), cleaning the surface of the titanium-based substrate.

36. (new): A method for forming an oxidation protective coating on a surface of a titanium-based substrate, comprising:

a) cleaning the surface of the titanium-based substrate;

b) depositing an aluminum conversion layer on the surface of the titanium-based substrate, wherein the aluminum conversion layer comprises aluminum;

c) oxidizing a first portion of the aluminum conversion layer to form an outer alumina layer; and

d) diffusing a second portion of the aluminum conversion layer into the titanium-based substrate, wherein a titanium aluminide layer is formed beneath the alumina layer.

37. (new): The method of Claim 36, wherein step a) comprises cleaning the surface of the titanium-based substrate with a caustic solution.

38. (new): The method of Claim 36, wherein step c) is performed at a first temperature, step d) is performed at a second temperature, and wherein the second temperature is substantially higher than the first temperature.

39. (new): A method for forming an oxidation protective coating on a surface of a titanium-based substrate, comprising:

a) depositing an aluminum conversion layer on the surface of the titanium-based substrate, wherein the aluminum conversion layer is deposited at a temperature of less than about 550° C;

b) heat treating the aluminum conversion layer at a controlled rate to form a coated substrate comprising an outer alumina layer and a titanium aluminide layer, wherein the titanium aluminide layer is formed between the titanium-based substrate and the alumina layer, and wherein step b) comprises heating the aluminum conversion layer at a rate of from about 25 to 100° C per hour when the temperature during step b) is above 500° C; and

d) cooling the coated substrate at a controlled rate, whereby cracking of the titanium aluminide layer is prevented, wherein step c) comprises cooling the coated substrate at a rate of from about 15 to 60° C per hour.

40. (new): The method of Claim 39, further comprising:

e) prior to step d), holding the temperature attained during step b) for a p riod of from about 5 minutes to 2 hours.

41. (new): The method of Claim 39, wherein the aluminum conversion layer has a thickness in the range of from about 0.5 to 40 microns.

42. (new): The method of Claim 41, wherein the titanium aluminide layer is formed to a thickness in the range of from about 1 to 80 microns.

43. (new): A coated titanium-based substrate prepared according to the method of Claim 36.

44. (new): An oxidation protective coating for a titanium-based alloy substrate, comprising:

a layer of titanium aluminide disposed directly on a surface of the titanium-based alloy substrate, wherein the layer of titanium aluminide comprises $TiAl_3$; and

a layer of alumina (Al_2O_3) disposed directly on the layer of titanium aluminide, wherein the layer of alumina has a thickness in the range of from about 0.5 to 5 microns.

45. (new): The protective coating of Claim 44, wherein the layer of titanium aluminide has a thickness in the range of from about 1 to 80 microns.

46. (new): The protective coating of Claim 44, wherein the layer of titanium aluminide has a thickness in the range of from about 2 to 15 microns.

47. (new): The protective coating of Claim 44, wherein the titanium-based alloy substrate comprises a braze disposed thereon, and wherein the braze comprises titanium.

48. (new): A titanium-based component, comprising:

a titanium-based substrate; and

an oxidation protective coating disposed on the titanium-based substrate, wherein the oxidation protective coating comprises:

a layer of titanium aluminide disposed directly on a surface of the titanium-based substrate, wherein the layer of titanium aluminide comprises $TiAl_3$; and

a layer of alumina (Al_2O_3) disposed directly on the layer of titanium aluminide, wherein the layer of alumina has a thickness in the range of from about 0.5 to 5 microns.

49. (new): The titanium-based component of Claim 48, wherein the component comprises a panel of a heat exchanger.

50. (new): The titanium-based component of Claim 48, wherein the component comprises a titanium-containing braze disposed on the titanium-based substrate.